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THE ARSENIC CONTENT OF SHELLAC AND THE CONTAMINATION OF FOODS FROM THIS SOURCE.

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Orpiment, the yellow sulphid of arsenic, is very generally added to shellac in India for the purpose of rendering the product opaque and at the same time producing the light-straw color characteristic of the higher grades. This is of interest to the food chemist, the health official, and the consumer, for shellac is used as a coating for certain food products, such as some kinds of confectionery and bakers' products, and is largely used as a varnish on receptacles and containers of various kinds in many lines of food manufacture. Rosin is said to be added to lower the melting point, which is of advantage to some industries. It is also much cheaper than shellac.

The addition of mineral coloring matters to shellac has long been practiced. Van Linschoten, who is reported to have been sent to India by Portugal, stated in 1596 that "when the lac is raw, as it commeth from the tree, it is a darke red colour, but being refined and cleansed they make it of all colours of India." Baden-Powell, in his handbook of "The Manufactures and Arts of the Panjab," in discussing the manufacture of lacquered ware, writes: "Mineral colors are mostly used. The yellow is made with orpiment; green with arsenite of copper; red with red lead or vermilion; blue with imitation 'lájward' or Prussian blue." The addition of orpiment to shellac, as well as rosin, is discussed in some detail by Watt,[1] who says in part: "According to the particular class of manufacture desired lac is now very often mixed with either or both of the following substances, namely, orpiment or yellow arsenic and resin. The latter is obtained for the most part from Canada (pine rosin). The former is procured in India and apparently serves mainly (if not entirely) a mechanical purpose. It makes the lac opaque, but at the same time

[1] Lac and the Lac Industries, by George Watt, reporter on Economic Production to the Government of India. The Agricultural Ledger, 1901, No. 9.

imparts to it a rich pale straw color, properties characteristic of all the finer grades of handmade shellac. Arsenic is not, however, employed in the manufacture of 'garnet,' 'button,' and the other grades where paleness of color is not so much demanded. * * * During seasons of high prices the admixture of rosin is often raised until it passes from the condition of permissible admixture to what might be called criminal adulteration."

Shellac has been used by many of the larger confectioners to the extent of several barrels a month each primarily for the purpose of giving the goods so treated a gloss or high finish and a superior appearance. The amount of dry shellac on these candies varies from a small fraction of a per cent to 1.5 per cent, depending on the amount of surface exposed and the thickness of the coating. Penny goods and those usually consumed by children, such as fudge of various kinds, peanut bars, sugar-coated peanuts, imitation chocolate cigars, etc., are more often shellacked than other classes of confectionery.

Orpiment is not readily soluble. In fact, it is nearly insoluble in alcohol, which is ordinarily used as the vehicle of shellac, and a yellow deposit of the arsenical compound tends to settle to the bottom, which concentrates the arsenic in the dregs of each container, so that a larger amount is applied to the articles last varnished.

When used as a coating for food receptacles the insolubility of orpiment and the shellac itself prevents any great amount of the former from going into solution, but several samples of beer and ale from different manufacturers, examined by the writer, which were in contact with a coating of shellac throughout fermentation and aging, all gave strong traces of arsenic.

The brewing industry is a very large user of shellac, the products of many breweries being held in shellac containers from the time the wort leaves the brew kettle, throughout the fermentation and aging processes, until the consumer's glass is drawn "from the wood;" that is, a shellac-lined cask. Fermentation tanks are almost universally shellac varnished, several coats being applied once a year or oftener. Wooden stock tubs and storage tanks, chip casks, and many retail packages, especially those of ale, are also usually shellacked; and while the amount of arsenic imparted to the fermented beverages from this source is undoubtedly small this easily avoidable trace is added to any that may be present from the materials of the brew, and it should be remembered that arsenic is a cumulative poison and that the beer drinker consumes liberal quantities at not infrequent intervals.

In the table is shown the quantity of arsenic found in samples of shellac purchased at random on the open market, the duplicated

samples of the same mark being obtained from different dealers. The brewers' shellacs, a majority of which were cut in denatured alcohol, were obtained direct from the breweries. The arsenic as reported is calculated to the dry material.

Arsenic content of samples of commercial shellac.

No. of sample.	Arsenic as arsenious oxid (parts per million).	Mark.
1	225	D. C.
2	160	D. C.
3	150	D. C.
4	700	V. S. O.
5	950	V. S. O.
6	1,125	Fine Orange.
7	260	
8	890	
9	310	
10	525	
11	1,430	Ralli Superfine.
12	1,280	Standard T. N
13	325	L. & M. Pure T. N.
14	1,260	T. P. K. Pure T. N.
15	875	
16	40	Button.
17	28	A. C. Garnet.
18	50	Bleached shellac.
19	12	Do.
20	2,080	Confectioner's shellac.
21	4	Arsenic rosin free confectioner's shellac.
22	740	Brewer's shellac.
23	550	Do.
24	520	Do.
25	175	Do.
26	37	Do.
27	32	Do.
28	15	Do.

The data show that all of the samples examined contained arsenic. Several alternatives are open to the food manufacturer who wishes to reduce the possibility of arsenical contamination from this source to a minimum. Foreign shippers state that a shellac free from arsenic and rosin may be procured if specially manufactured. Bleached shellac usually contains much less arsenic than unbleached shellac because of the washing to which it is subjected after bleaching. The grades known as "button" and "garnet" contain but small amounts of arsenic, judging from the analyses reported and the statement of Watt,[1] these probably being due to accidental contamination. In the case of the brewer the "glass lined" metallic storage tanks which are rapidly coming into use do away with the need of varnish on these receptacles, which also have the advantage of being very easily cleansed, but the disadvantage of additional cost. Some brewers are using paraffin on all wooden vats, which costs less than shellac, and is reported to give satisfaction.

The addition of orpiment to shellac appears to be wholly unjustifiable, for it works a twofold prejudice to the purchasers of this product: First, to the importer and dealer who judge the quality of

[1] Loc. cit.

the shellac largely by its color and opaqueness, which characteristics are altered by the addition of orpiment. In other words, by the addition of orpiment the manufacturer can sell a shellac of medium or even inferior color and quality as a superior grade. Second, the person using the shellac, in addition to being misled as to its quality, unwittingly uses a product containing arsenic, which, in the case of a manufacturer of foods, is a most serious matter from either an ethical or a commercial viewpoint.

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